EXHIBIT 3

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

IN RE NATIONAL PRESCRIPTION OPIATE LITIGATION	
This document relates to:	MDL No. 2804
The County of Summit, Ohio, et al. v. Purdue Pharma L.P., et al., Case No. 18-op-45090	Hon. Dan Aaron Polster
The County of Cuyahoga, Ohio, et al. v. Purdue Pharma L.P., et al., Case No. 17-op-5004	

CORRECTED AND RESTATED EXPERT REPORT OF KEVIN M. MURPHY, Ph.D.

June 21, 2019

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I. CREDENTIALS

1. My name is Kevin M. Murphy. I am the George J. Stigler Distinguished Service Professor of Economics in the Booth School of Business and the Department of Economics at The University of Chicago, where I have taught since 1983.

2. I earned a doctorate degree in economics from The University of Chicago in 1986. I received my bachelor's degree, also in economics, from the University of California, Los Angeles, in 1981.

3. At The University of Chicago, I teach economics in both the Booth School of Business and the Department of Economics. I teach graduate level courses in microeconomics, price theory, empirical labor economics, and sports analytics. In these courses, I cover a wide range of topics, including the incentives that motivate firms and individuals, the operation of markets, the determinants of market prices, and the impacts of regulation and the legal system. Most of my teaching focuses on two things: how to use the tools of economics to understand the behavior of individuals, firms and markets and how to apply economic analysis to data. My focus in both research and teaching has been on integrating economic principles and empirical analysis.

4. I have authored or co-authored more than 65 articles in a variety of areas in economics. Those articles have been published in leading scholarly and professional journals, including the American Economic Review, the Journal of Law and Economics, and the Journal of Political Economy. I have published in the area of health economics, and was co-

editor of a book discussing the gains from medical research.[1] I have also published articles discussing the economics of addiction and articles discussing the markets for illicit goods.

5. I am a Fellow of the Econometric Society and a member of the American Academy of Arts and Sciences. In 1997, I was awarded the John Bates Clark Medal, which the American Economic Association awarded once every two years to an outstanding American economist under the age of forty. In 2005, I was named a MacArthur Fellow, an award that provides a five-year fellowship to individuals who show exceptional merit and promise for continued and enhanced creative work. In 2007, my colleague Robert Topel and I won the Kenneth J. Arrow Award, which is given annually by the International Health Economics Association for the best research paper in health economics.

6. In addition to my position at The University of Chicago, I am also a Senior Consultant to Charles River Associates ("CRA"), a consulting firm that specializes in the application of economics to law and regulatory matters. I have consulted on a variety of intellectual property, antitrust, fraud, and other matters involving economic and legal issues, such as damages, class certification, labor practices, exclusionary access, tying, mergers, price fixing, price discrimination, and joint ventures.

7. I have submitted testimony in Federal Court, the U.S. Senate, and to state regulatory bodies, and I have submitted expert reports in numerous cases. I have testified on behalf of the U.S. Federal Trade Commission and I have consulted for the U.S. Department of Justice. A list of the testimony I have given over the past four years is provided in my CV, attached as Appendix A. CRA charges $1,400 per hour for my time spent on this matter, and

[1] Murphy, Kevin M., and Robert H. Topel, *Measuring the Gains from Medical Research: An Economic Approach,* University of Chicago Press, 2003.

I receive other compensation from CRA as well. My compensation and the compensation to CRA do not depend on the outcome of this matter.

8. My opinions are based on the information available to me as of the date of this report. The materials that I have relied upon in forming the opinions I offer in this report are identified in Appendix B. My work is ongoing, and I will continue to collect data and other information relevant to the issues and opinions that I discuss in this report. I will review, evaluate, and analyze any relevant material that becomes available to me, and I will supplement my report as necessary to reflect this information. I reserve the right to supplement my opinions based on any additional information obtained that I may be asked to consider, or any additional work or analysis that I may be asked to perform prior to or at any hearing, including deposition or trial. Such additional information includes, without limitation, testimony of Plaintiffs' expert witness Mr. McCann, which was not completed in time to be considered for the purposes of this report. I may supplement and update this report as appropriate based on the results of review procedures and/or additional information that may become available. If asked to offer testimony at trial, I may use documents produced in this litigation that refer to or relate to the matters discussed in my report as exhibits. In addition, I respectfully reserve the right to use animations, demonstratives, enlargements, or any other enhancement in kind of the tables or graphs presented in my report or other information that illustrate my opinions.

II. ASSIGNMENT AND SUMMARY OF CONCLUSIONS

A. Assignment

9. The counties of Summit, Ohio and Cuyahoga, Ohio (the “Plaintiffs” or “Counties”) assert in their complaints two categories of claims: “claims against the

between 1997 and 2010, "with counties that received more shipments experiencing higher mortality rates."[101] I explained above that an observed correlation between prescription opioid shipments and opioid mortality does not mean that shipments caused mortality. An observed correlation also does not imply that counties that received high opioid shipments always had high levels of opioid-related mortality or that counties that received low opioid shipments always had low levels of opioid-related mortality. On the contrary, many counties in the top quartile of shipments had below-average mortality rates, and many counties in the bottom quartile of shipments had above average mortality rates.

116. Exhibit 22 shows the percentage of counties in the bottom shipments quartile with mortality rates that were higher than the population-weighted mean mortality rate across the 400 counties in Professor Gruber's sample.[102] The exhibit also shows the percentage of the population in the bottom shipments quartile that lives in counties with above-average mortality.

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101 Gruber Report at ¶ 87.

102 I show in Exhibits 22 and 23 the same quartiles as Professor Gruber. Professor Gruber applies weights based on the county population. There are therefore different numbers of counties in each quartile, but each quartile has roughly the same number of people (per the populations of the counties in each quartile). His bottom-shipment quartile is comprised of 68 counties and his top-shipment quartile is comprised of 103 counties. I also apply population weights when determining the mean mortality rate across the 400 counties, which is consistent with how Professor Gruber calculates the mean mortality within the top and bottom quartiles.

Exhibit 22

Many Low-Shipment Counties Have Above-Average Opioid Mortality

Year	National Average Any Opioid Mortality	Share of Counties in **Bottom**-Shipment Quartile with Mortality Rates **Above** the National Average	
		Share of Counties	Share of Population
1999	4.4	15%	50%
2000	4.5	10%	23%
2001	4.7	18%	27%
2002	5.9	9%	22%
2003	6.2	12%	12%
2004	6.3	7%	3%
2005	6.8	15%	9%
2006	7.8	13%	17%
2007	8.2	10%	3%
2008	8.5	10%	3%
2009	8.7	25%	8%
2010	8.8	15%	5%
2011	9.6	19%	6%
2012	9.8	18%	5%
2013	10.3	16%	5%
2014	11.4	16%	5%
2015	13.0	19%	6%
2016	16.7	22%	20%

Source: Backup materials to the expert report of Professor Gruber.

117. The analysis in Exhibit 22 shows that, among counties with the lowest shipments, the share of counties with above-average mortality rates ranges from seven to 25 percent for each year from 1999 through 2016.[103] The percentage of the population living in these counties ranges from three to 50 percent, depending on the year. Thus, a number of counties with relatively few shipments have relatively high opioid mortality rates.

[103] Cuyahoga County is in the bottom second shipment quartile and Summit County is in the third shipment quartile. The opioid mortality rates in Cuyahoga and Summit are sometimes above and sometimes below the national average, depending on the year.

170. There are at least three reasons why the statement in (2) is not informative of the inequality expressed in equation (1). The first is that, by focusing on the statement in (2), Professor Cutler is studying the wrong population. He focuses on the population that uses heroin rather than on the population that uses prescription opioids. This flaw can be seen most clearly if I replace prescription-opioid use with some other behavior, especially a behavior with high prevalence among non-heroin users. For example, the probability of drinking water conditional on using heroin or fentanyl is likely 100 percent, but this does not tell us anything about the probabilities expressed in (1). Indeed, evidence suggests that the population of prescription opioid users (the correct population to consider here) includes only a very small percentage of people who later abuse heroin.[153]

171. The second reason why Professor Cutler's approach is flawed is that he is looking at heroin use in the wrong (pre-2010) period. It is incorrect to focus on people who used heroin before 2010 in order to explain the patterns of heroin use after 2010, especially because Professor Cutler himself argues that there was a break or shift in 2010 that forced him to use a different methodological approach to analyze the post-2010 period. Moreover, mortality data show that those misusing heroin or fentanyl in the post-2010 period were

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153 Evans, William N., Ethan M.J. Lieber, and Patrick Power, "How the Reformulation of OxyContin Ignited the Heroin Epidemic," *The Review of Economics and Statistics 101(1)*, March 2019, pp.1-15, at p. 5: "According to data from the third quarter of 2010 through the end of 2014 in the annual NSDUH, among respondents who used pain medicine recreationally over the past year, less than 1 percent said they ever used heroin." Gruber Deposition at 302:6-9: "It seems very likely to me that most would not progress use to heroin use. Heroin use is a much, much lower rate than nonmedical prescription." Gruber Deposition at 395:2-10: "I don't know [what percentage of people who had a prescription opioid for a legitimate medical need and later became addicted to heroin] offhand, although studies we've looked at during today have made reference to computations like that, of that nature, which suggest that a very small minority of people who get prescriptions then transition onto heroin."

younger, on average, than the individuals misusing prescription opioids in the pre-2010 period.[154]

172. Exhibit 35 shows the national licit and illicit opioid mortality rates for people in their 20s and 30s compared with those in their 40s and 50s over time. The exhibit shows licit mortality (the blue region) peaking at around 2010 and 2011 for both age groups, and the peak licit mortality slightly higher among for those in their 40s and 50s.[155] The exhibit also shows a larger increase in overall opioid mortality driven by an increase in illicit mortality (the green region) for those in their 20s and 30s than for those in their 40s and 50s in the post-2010 time period. In other words, in the later period, the younger demographic was more affected by illicit mortality than the older demographic, while in the earlier period the older demographic was slightly more affected by licit mortality than the younger demographic. This empirical finding is not consistent with Professor Cutler's claims that post-2010 illicit-opioid mortality was driven by prescription-opioid addicts moving to illicit opioids after 2010.

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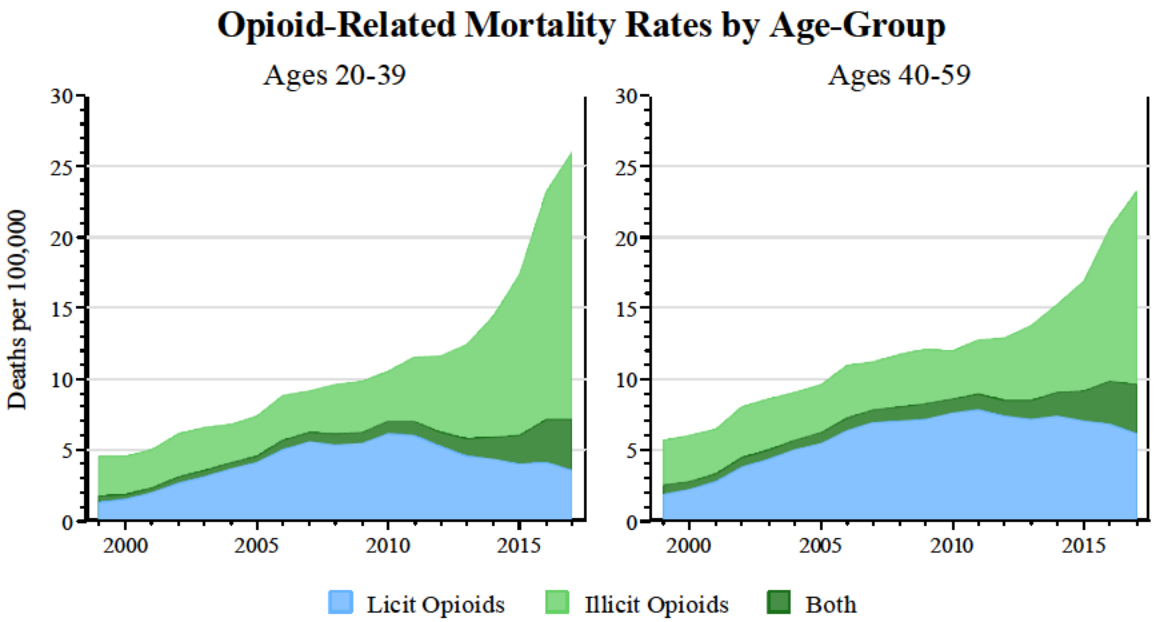
154 Ciccarone (2017) at p. 108.

155 For Exhibits 35 and 36, I rely on mortality data from CDC Wonder. I define licit mortality as mortality where drug poisoning is listed as the underlying cause of death, and a licit opioid ("methadone" or "other natural/semisynthetic opioids") is listed among the up to 20 additional "multiple" causes of death. I define illicit mortality as mortality where drug poisoning as the underlying cause of death, and an illicit opioid ("heroin," "opium," "synthetic opioids other than methadone," or "other unspecified narcotics") is listed as a multiple cause of death. A difference between this definition and the definition used by Professors Cutler and Gruber, is that Professors Cutler and Gruber classify those with both a licit opioid and an illicit opioid as a multiple cause as "illicit mortality." In Exhibit 35, I show these as "Both," and I include these deaths in both the "Licit Mortality" and "Illicit Mortality" panels in Exhibit 36.

Exhibit 35



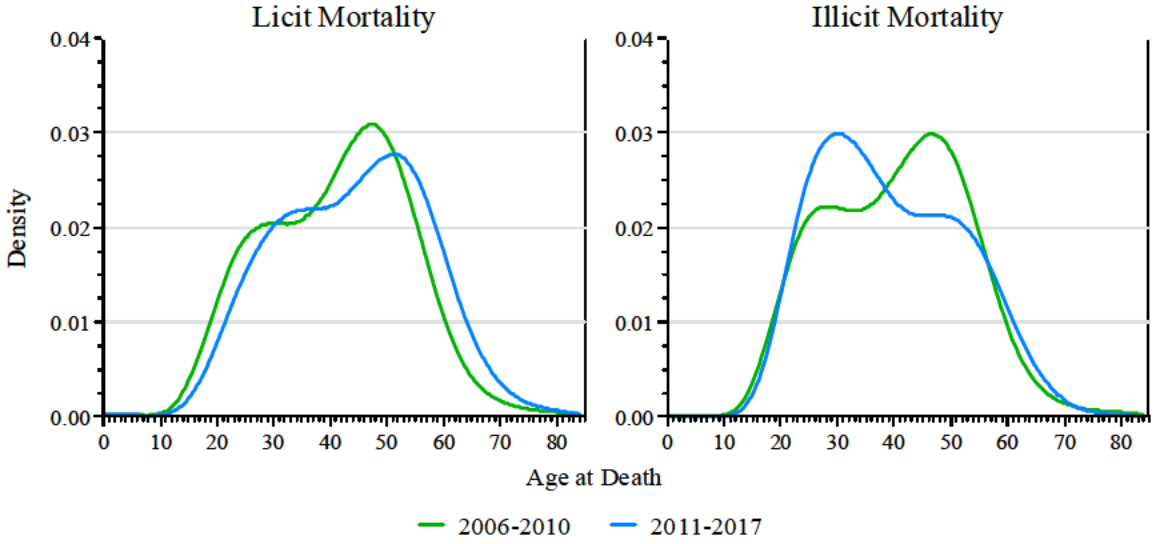
Note: Licit opioids include methadone (ICD-10 code T40.3) and other natural/semisynthetic opioids (T40.2), which includes drugs such as hydrocodone and oxycodone. Illicit opioids include heroin (T40.1), opium (T40.0), synthetic opioids other than methadone (T40.4), and other and unspecified narcotics (T40.6).

Source: CDC Wonder.

173. Exhibit 36 shows the age distribution for licit and illicit mortality for the 2006-2010 period and for the 2011-2017 period. The panel on the left shows that the age distributions for each time period were similar for licit mortality. The panel on the right shows larger differences across the two illicit mortality age distributions. When looking at illicit mortality, the distribution shifted to the left after 2010, which shows that younger workers were more affected by illicit mortality in later years.

Exhibit 36

Post-2010 Illicit Mortality Affected Younger People with Greater Intensity Than Pre-2010 Illicit Mortality or Licit Mortality in Either Period



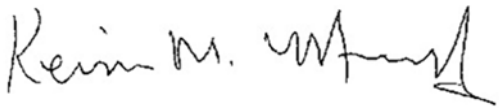
Note: Prescription opioids include methadone (ICD-10 code T40.3) and other natural/semisynthetic opioids (T40.2), which includes drugs such as hydrocodone and oxycodone. Illicit opioids include heroin (T40.1), opium (T40.0), synthetic opioids other than methadone (T40.4), and other and unspecified narcotics (T40.6).

Source: CDC Wonder.

174. The demographic patterns in Exhibits 35 and 36 do not provide evidence that post-2010 illicit mortality was driven by prescription opioid addicts in the pre-2010 period moving to illicit opioids in the post-2010 period.

175. Finally, Professor Cutler's approach is flawed because the raw probabilities mentioned in the studies he cites disregard the personal characteristics of individuals – the *X* vector in the inequality in (1) above – that could lead people to misuse both prescription and illicit opioids.

207. Professor Cutler states that "[d]rug crimes are defined to include those involving the purchase or sale of illicit drugs as well as estimates of the share of other crimes undertaken to obtain drugs or to obtain money to purchase drugs."[178] I note first that, by definition, these crimes do not involve prescription (licit) opioids. In addition, the amount of criminal activity associated with a particular type of drug need not be proportional to the number of seizures containing that drug, or to the share of people with SUDs that have OUD. Moreover, the data on drug seizures count the number of times a particular drug was detected in a seizure. The data do not provide information on the weight of the drugs seized or the share of the seizure that involved an opioid (as opposed to another illicit drug).



Kevin M. Murphy, Ph.D.

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178 Cutler Report at ¶ 38.